INTERMEDIATE SCIENTIFIC INVESTIGATION PLANNING TEMPLATE

Our **question** is: **How do different amounts of acid affect plants?**

Our **prediction** is: **Any amount of acid will damage the plants, but the highest concentration will damage them the most.**

The **materials** we will use are (include measuring tool):

- vinegar
- water
- tablespoon
- string
- popsicle sticks (4)
- bottles to mist plants with solution
- plants

The **variable** we are **changing** is:
The amount of acid.

The **measured** (responding) **variable** is**:**
The condition of the plants post-acid spray.

These are the **controlled variables** (things kept the same):

- **Other water plants are given**
- **Same kind of plant (do this to all lettuce, for example)**
- **sunlight**

The step-by-step **procedure** is:

1. **Split class into groups of 3. Have each group divide a small sector of the garden into 4 same-sized plots using the string. Grab rocks to hold the string in place.**
2. **Label each sector with a popsicle stick, 1-4.**
3. **In the classroom, mix up four different solutions of water and vinegar. The first mixture should be straight vinegar. The second mixture should be 3 cups of water to 1 tablespoon of vinegar. The third mixture should be 6 cups of water to 1 tablespoon vinegar. The last mixture should just be water.**
4. **Record observations about the plants and have students draw them. Size? Shape? Color? Any already existing abnormalities?**
5. **Fill up bottles, each with one solution and mist the plants in this sector with it. Spray ten times on each plant. Make sure to make a note of the sector where each mixture was sprayed.**
6. **Check back the next day to see what happened to the plants. Spray the solutions again, if the plants show no sign of damage. Record differences from one day to the next.**
7. **After 3 days determine which plant was affected the most. Record observations of all of them, again noting size, shape, color, etc. Draw them as well. What connections can we see between high levels of acid and plant condition? Did the most damaged plant align with our predictions?**

DATA TABLE

Title of the Data Table

CHANGED (manipulated) VARIABLE		Trial One (in cm)	Trial Two (in cm)	Trial Three (in cm)	Average (in cm)

Conclusion:

- ☐ Prediction
- ☐ Low data
- ☐ High data
- ☐ Wrap it all up

Total Score _____

Next investigation:

What question might you ask next to lead you into another investigation?

What would happen if we put base on the plants? So we used baking soda, instead of vinegar.

Scoring Items	Point
Prediction	
Materials	
Procedure (written or diagrammed with logical steps)	
Variable kept the same (Controlled Variable)	
Variable Changed (Manipulated Variable)	
Variable Measured (Responding Variable)	
Recorded measurements into a Data Table	
Trials are Repeated	
Total Score (8 possible points)	

Grade(s) : 3

Subject Area: Science

EALR/Standard:

2-3 Inquiry (A-D)

2-3 Life Science 1A; 2A 2C and 2D

2-3 Earth Science 2A

Activity: What effect does acid have on the condition of a plant? Use this lesson as a greater discussion of the effects of acid rain.

Lesson created by Robin Lewis, Environmental Studies Intern, Whitman College Spring 2010

Goals:

- Understand, firsthand, the impact of acid on plants.
- Extrapolate from this information, what this means for the ecosystem at large, which is suffering from acid rain deposition.
- Students understand what acid rain is, what causes it, and what can be done to stop it.

Brief description:

Students use basic chemistry to see how different acid solutions affect plants with a follow-up discussion of how this is similar (and different) from acid rain.

Complete lesson plan on back:

Materials

Students need an Investigation Planning Template, a garden plot, and 4 different acid solutions. Teacher will want to have a map of the United States as well as pictures of real acid rain damage to show children how it moves from the Midwest to the East Coast, what causes it, and what happens to ecosystems affected by it. The powerpoint can also be used as a visual aid.

Procedure

(See above in worksheet)

Additional Activity

Use experiment to breach a discussion of acid rain. Explain what acid rain is, where in the US it precipitates the most (East Coast), what causes it (cars, coal plants, factories, etc), and what it does. Have students connect their findings to the discovery of this real life example of acid affecting plants. Use this as an opportunity to explain weather and wind patterns; bring in pictures of and news stories about acid rain to get a broader and more interdisciplinary perspective of the issue. Talk about what it being done and what they can do to help stop acid rain. It is important to draw the local connections the students make about the acid rain on their mini ecosystem to a more national perspective.

New vocabulary

____acid rain_____ _____ _____ _____